Appendix F. Sediment Delivery Studies and Modeling Efforts

CONTENTS

INTRODUCTION

This appendix presents a description of the sediment delivery studies and the sediment modeling efforts conducted by Green Diamond Resource Company (Green Diamond). These projects were undertaken to estimate future long-term sediment delivery volumes to watercourses from roads and landslides within the Plan Area. The empirically-based model was designed to comparatively evaluate average long-term sediment delivery from roads and landslides under different management scenarios. The structure of the model enables Green Diamond to examine a wide range of management scenarios to identify the most efficient and effective prescriptions that will sufficiently reduce future management-related sediment delivery to meet the needs of aquatic resources of concern.

Model Data Base

Green Diamond conducted two extensive sediment delivery studies. One study involved the compilation of landslide inventories to evaluate landslide-related sediment delivery. Average long-term sediment delivery volumes from shallow and deep-seated landslides were evaluated for three pilot watersheds covering roughly 10% of the Plan Area: Salmon Creek, Little River, and Hunter Creek. Delivery rates were based on standard interpretations of aerial photographs with a limited amount of field verification. Sediment delivery from deep-seated landslides was also estimated in the Upper Mad River pilot watershed based on published data. The impact of harvesting on landslides and landslide-related sediment delivery was evaluated from the landslide inventory data collected in the pilot watersheds, from published reports, and complemented by professional judgment where data were lacking. A summary of the results of the landslide inventory and associated analysis is included as Appendix F1.

The second data collection effort was a field-based road inventory of 518 miles of road in five pilot watersheds to evaluate future sediment sources and sediment delivery related to the road network. The road-related sediment source inventories employed standard road inventory protocols developed by Pacific Watershed Associates, which have been used on forest and ranch lands throughout the north coast. The inventories were designed to quantify potential future sediment delivery from road-related landslides, watercourse crossing failures, and “other” sites (such as problems with ditch relief culverts and related gullies) associated with Green Diamond’s road network. As part of Green Diamond’s modeling effort described in this appendix, the road inventory data were summarized and applied to the Green Diamond ownership within the 11 HPAs to develop potential road-related sediment delivery estimates. These data were also instrumental in developing site-specific erosion prevention measures as well as general road-related erosion prevention measures that were incorporated into the Plan. A summary of the road inventory data is included as Appendix F2.

Green Diamond used the road-related sediment source data and landslide-related sediment data to parameterize a simple sediment delivery model for the Plan Area. This model was subjected to Monte Carlo simulation analyses to evaluate changes in forecast variables given ranges of uncertainty in the model’s parameters. The use of empirically-based sediment inventory methods and Monte Carlo simulation enabled Green Diamond to comparatively analyze average long-term sediment delivery under a variety of management scenarios and conservation measures. It was through this

comparative analysis that Green Diamond developed the accelerated road-related erosion prevention strategy (see Section 6.3.3) and appropriate slope stability conservation measures (see Section 6.3.2) that are expected to meet the needs of the aquatic resources of concern. A description of the Plan Area model and the Monte Carlo simulation results are included as Appendix F3.

Limitations of the Model

The model quantified only those sediment sources and processes that were considered to be among the most prolific sediment contributors and that may be affected by management prescriptions. The conservation measures developed from the model focused on those prescriptions that were expected to have the greatest benefit to the covered species, provide the highest confidence of success, and are logistically and economically feasible. Conversely, prescriptions that were expected to result in only a marginal benefit, provide low confidence of success, and that are logistically or economically infeasible were avoided.

The model is best suited for comparative analysis of road and landslide related sediment delivery, and it is not intended to be a comprehensive sediment budget. Although the model does not address all possible forms of management-related sediment delivery, such as legacy skid trail erosion, in-unit hillslope erosion, and stream bank erosion, conservation measures and BMPs have been developed, following the advice of experts both within the government and within the private sector, to address those potential sediment inputs.

The model does not differentiate between fine- and coarse-grained sediment. While the effectiveness monitoring and the adaptive nature of the conservation measures will be based only on sediment delivery and potential sediment delivery volume, the conservation measures as a whole are expected to have a significant effect on fine-grained sediment contributions. This is particularly true of the road-related and harvest-related-ground-disturbance conservation measures described in the Plan.

Finally, the sediment model does not address cumulative watershed effects (CWEs). It is not site specific, and it does not integrate past, current, and reasonably foreseeable projects. Instead, the sediment model is spatially-averaged over the Green Diamond ownership within the 11 HPAs and time-averaged over the next 50 years. This does not reflect actual sediment delivery processes, which are prone to occur in more of an episodic nature and vary locally, depending mostly on climatic conditions. However, the significance of this limitation is reduced by the adaptive management mechanisms in the Plan that are expected to provide appropriate elasticity for the conservation measures within individual HPAs to meet the needs of the aquatic resources of concern.

Although Green Diamond's modeling approach may overestimate sediment delivery in some places and underestimate it in other places, it is thought to be reasonably accurate overall. Therefore, Green Diamond believes the model is adequate for evaluating the most efficient and effective prescriptions to limit management-related sediment delivery in order to meet the needs of the species of concern, keeping in mind that some of the initial prescriptions are subject to adaptive management.